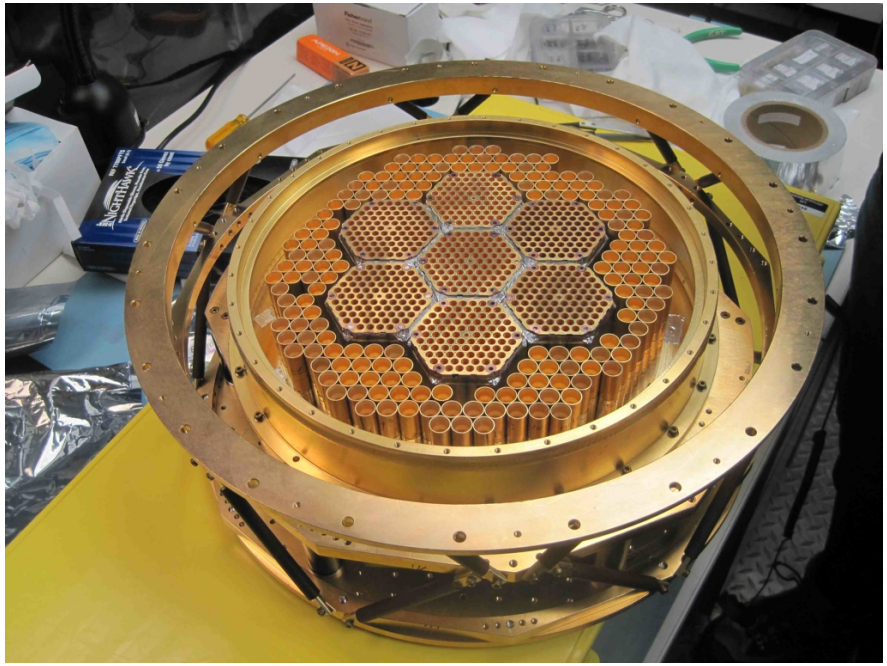
SPTpol: Accomplishments

Clarence Chang

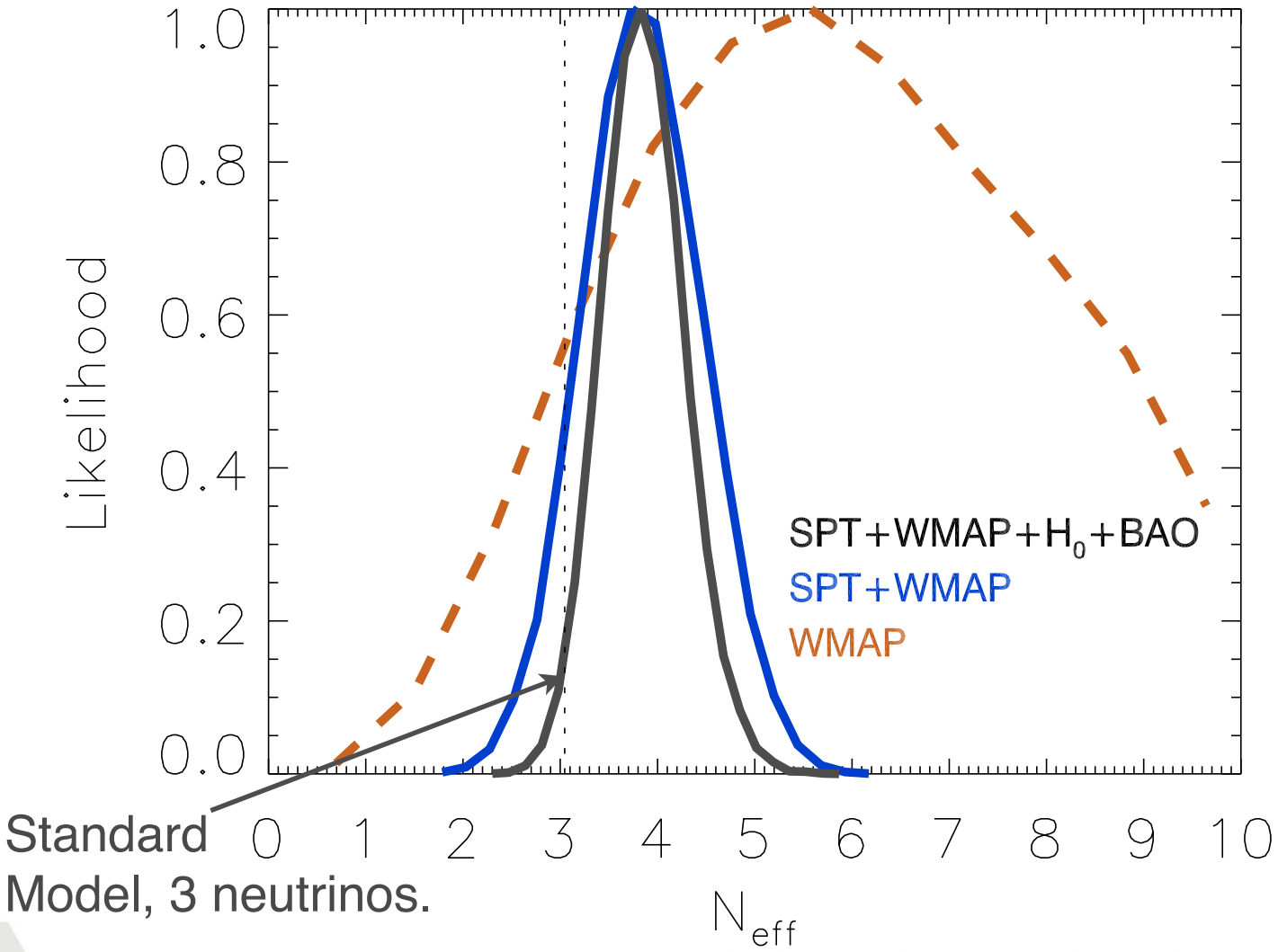
May 1, 2012



Science Highlight 1: Searching for new particles

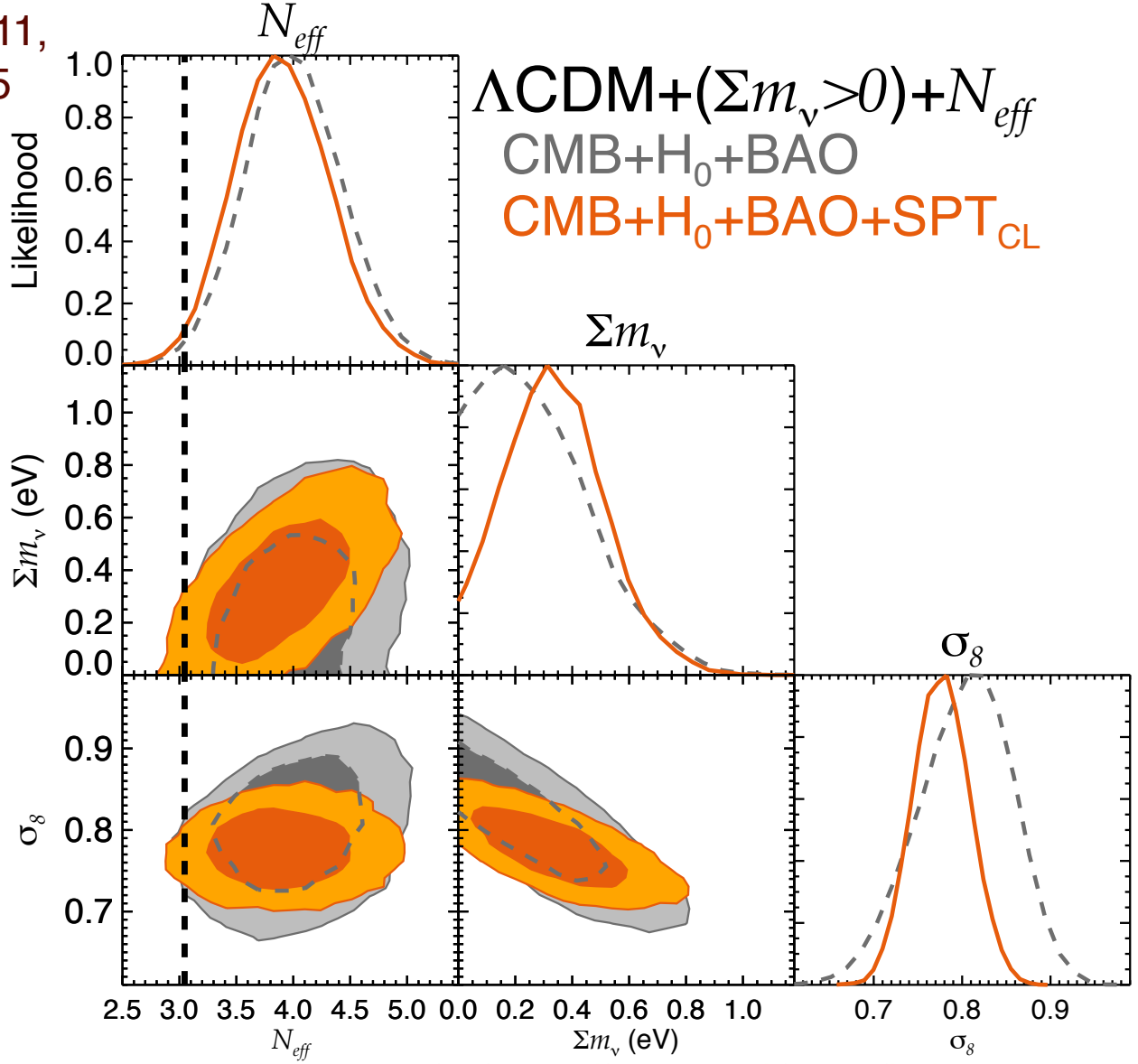
Keisler et al 2011, ApJ, 743, 28

$N_{eff} = 3.86 \pm 0.42$
(SPT+WMAP+H_0+BAO)



Science Highlight 2: Measuring neutrino mass

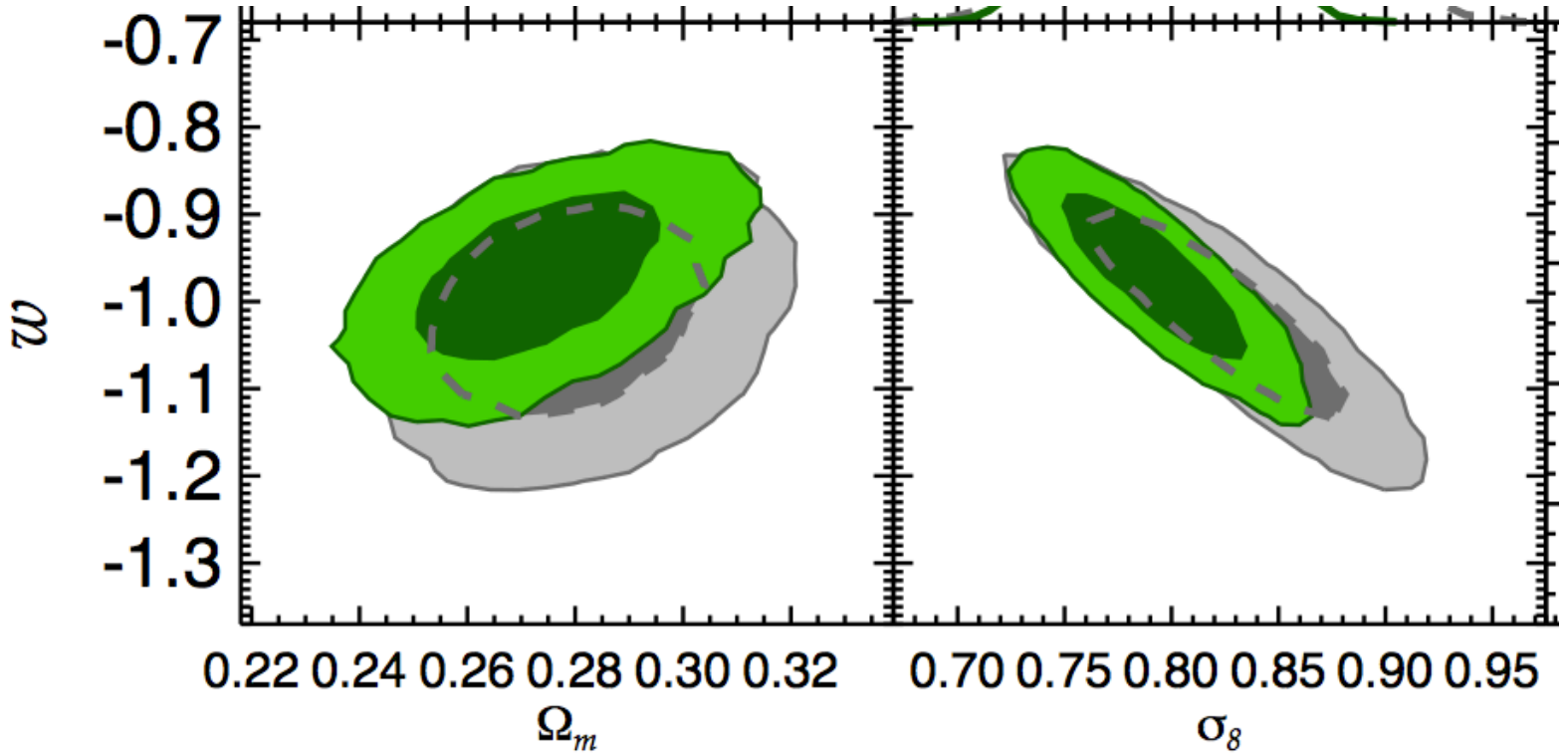
Benson et al 2011, arXiv: 1112.5435



Science Highlight 3: Probing Dark Energy

Benson et al 2011, arXiv: 1112.5435

w= -0.97 +/- 0.06



wCDM

CMB+BAO+SNe

CMB+BAO+SNe+SPT$_{CL}$

Fundamental Physics from SPTpol

Inflation

- CMB pol uniquely sensitive to Inflationary GW, physics at GUT-scale

Neutrinos

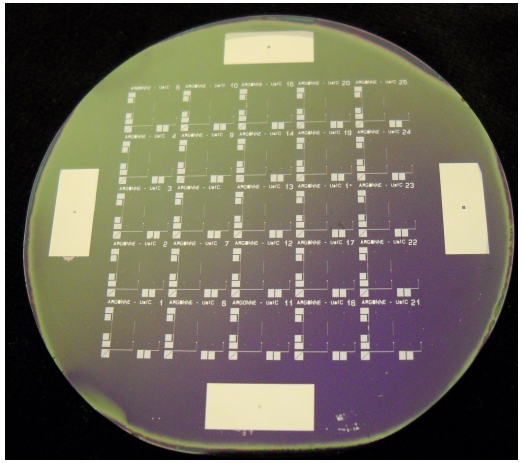
- Measure number of relativistic species (more than just 3 Standard Model neutrinos?)
- Lensing & structure constrains neutrino mass
- Polarization and total intensity complimentary measurements -> strong systematics!

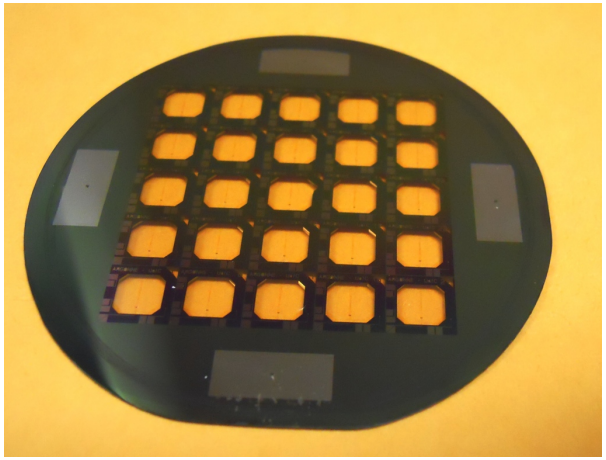
Dark Energy

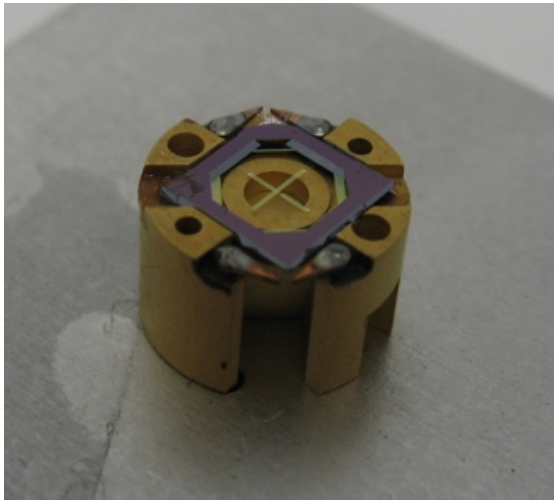
- Clusters measure growth vs geometry
- Overlap with DES -> strong systematics!
- lensing of CMB polarization sensitive to early DE models

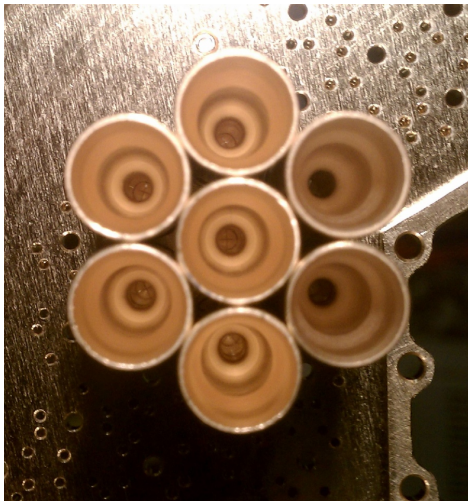
- SPTpol
  - 2x more detectors to increase scientific reach
  - expand SPT capabilities to measure polarization
  - Initial effort leveraged LDRD+UChicago support
  - Currently funded program

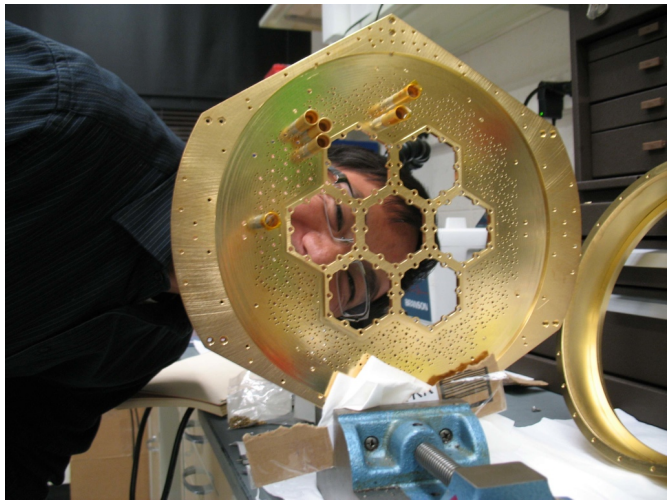
Focal Plane fabrication & installation



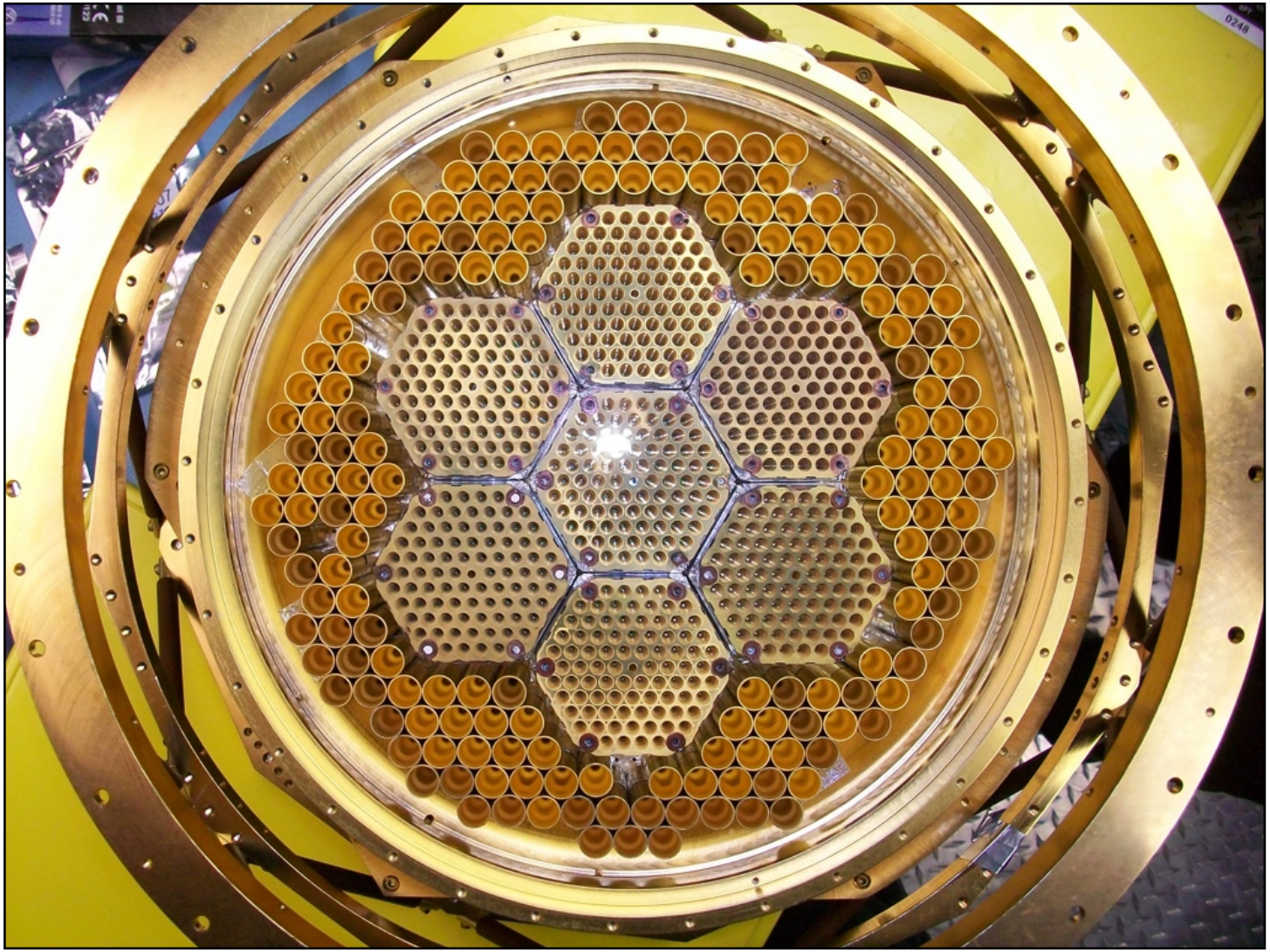


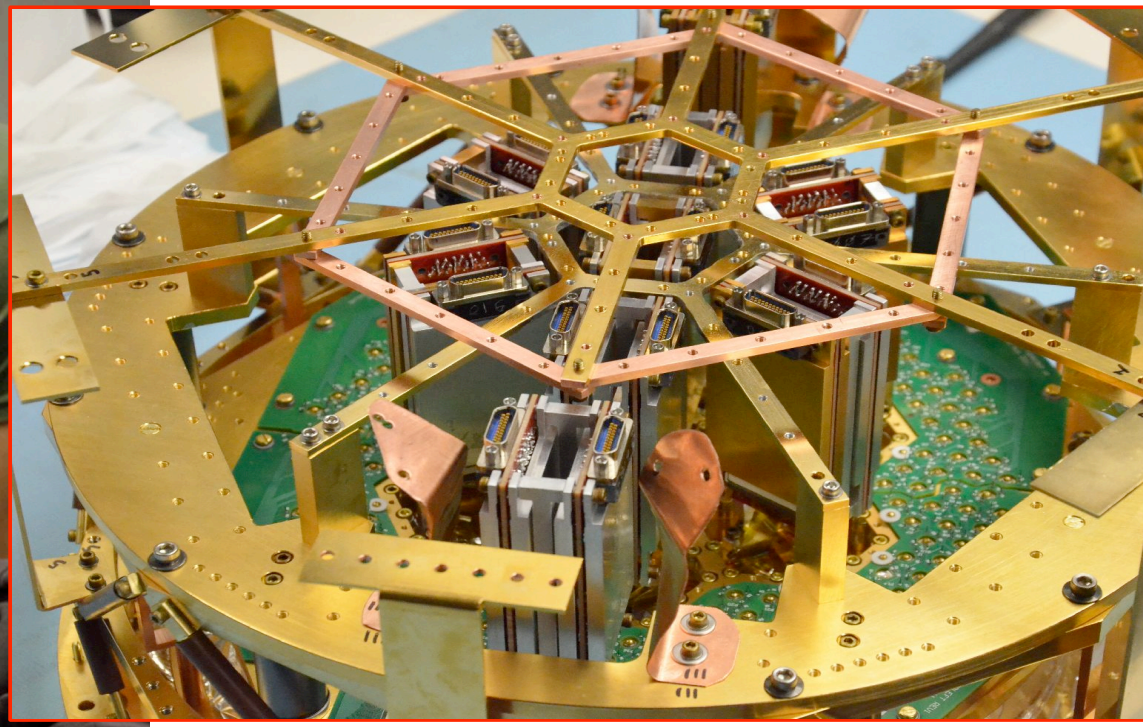


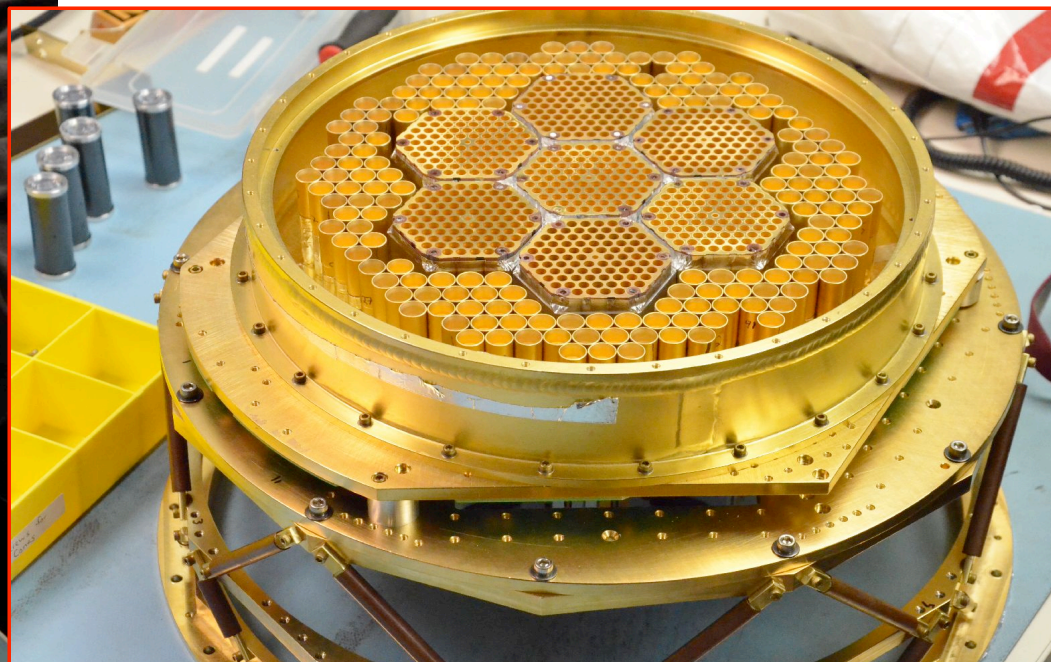


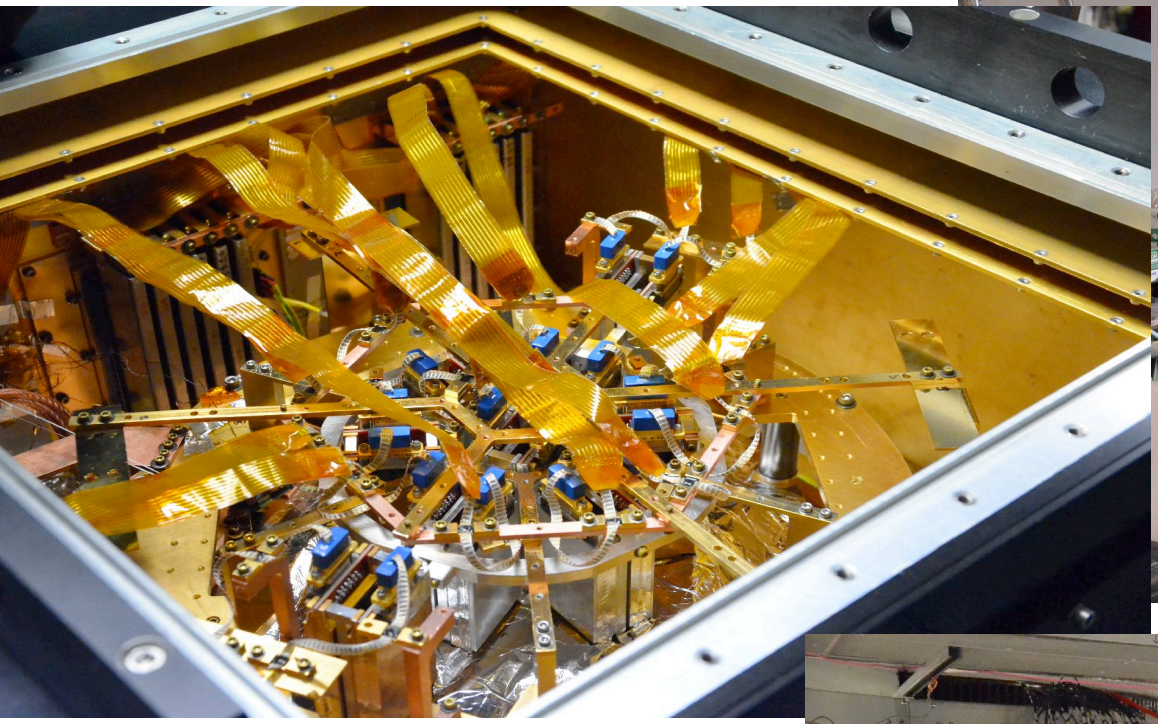


Focal Plane fabrication & installation

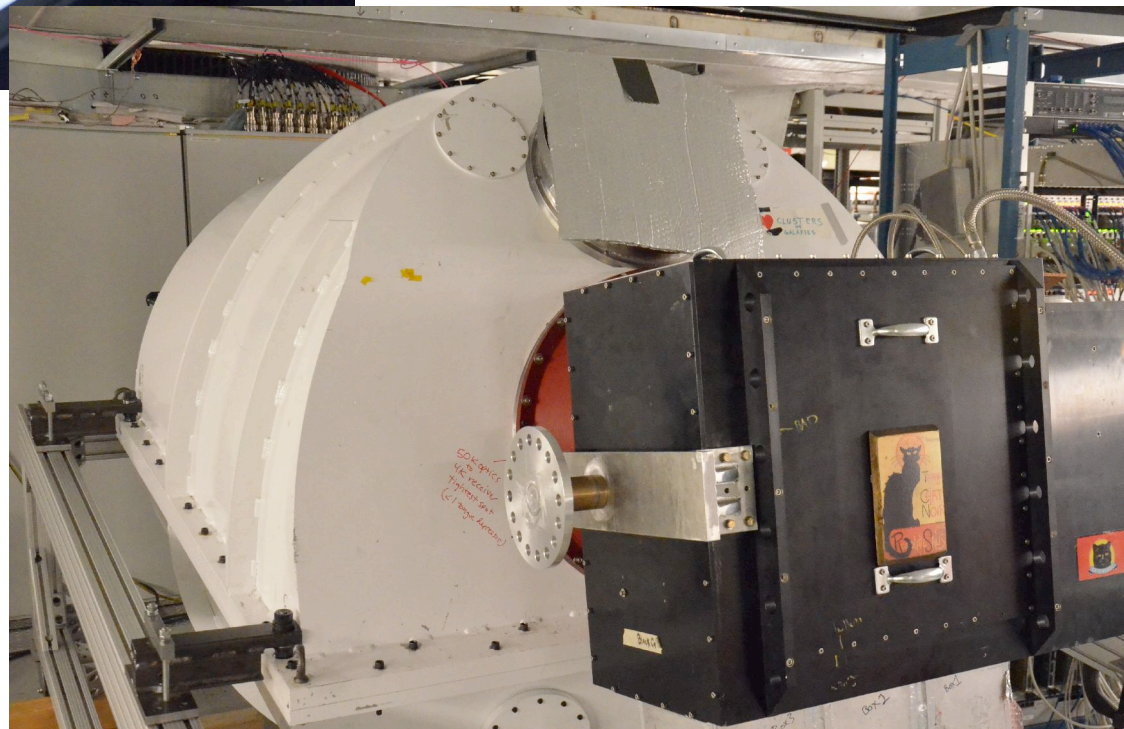








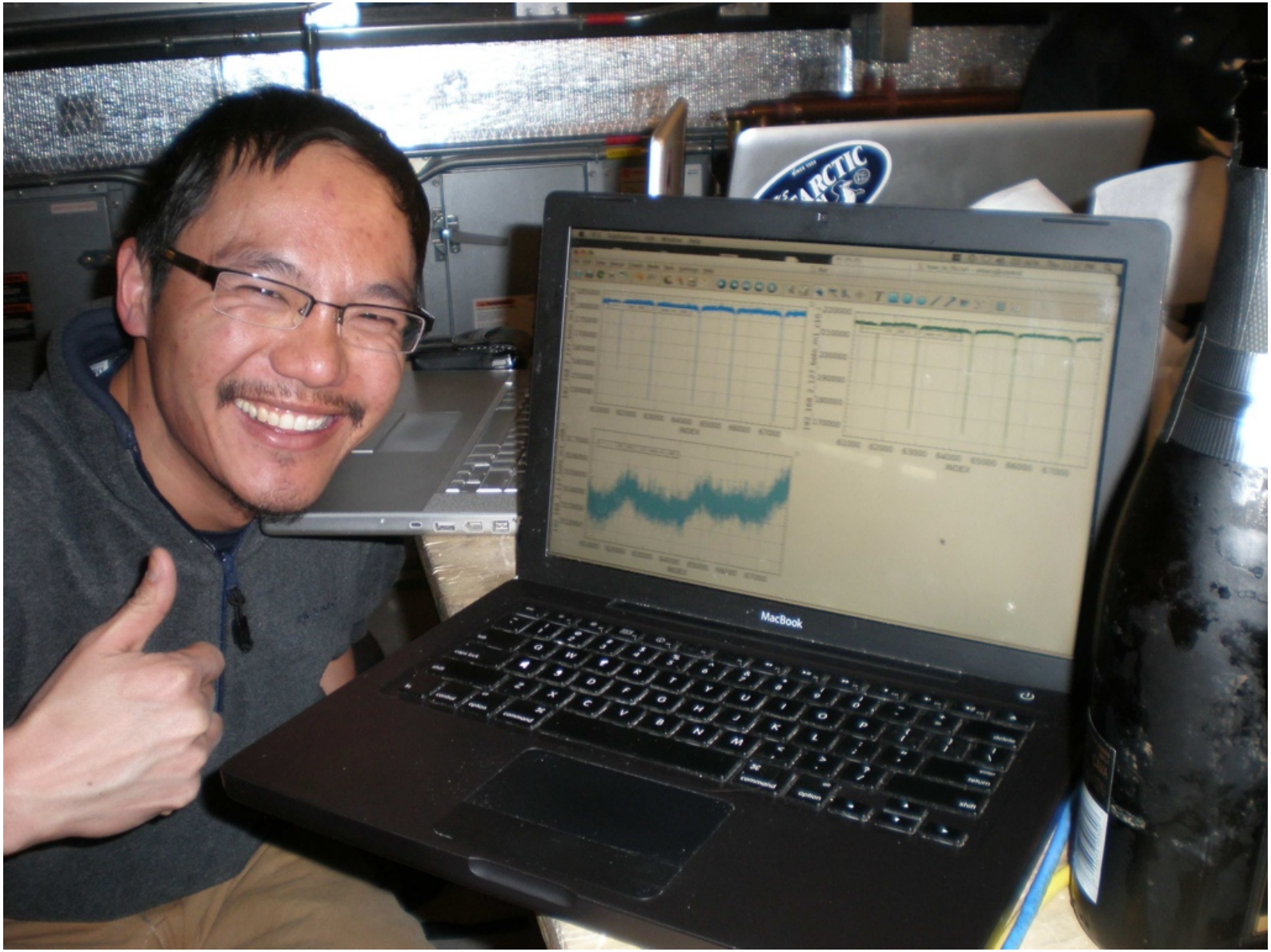

I
CLUSTERS
of
GALAXIES



First light!

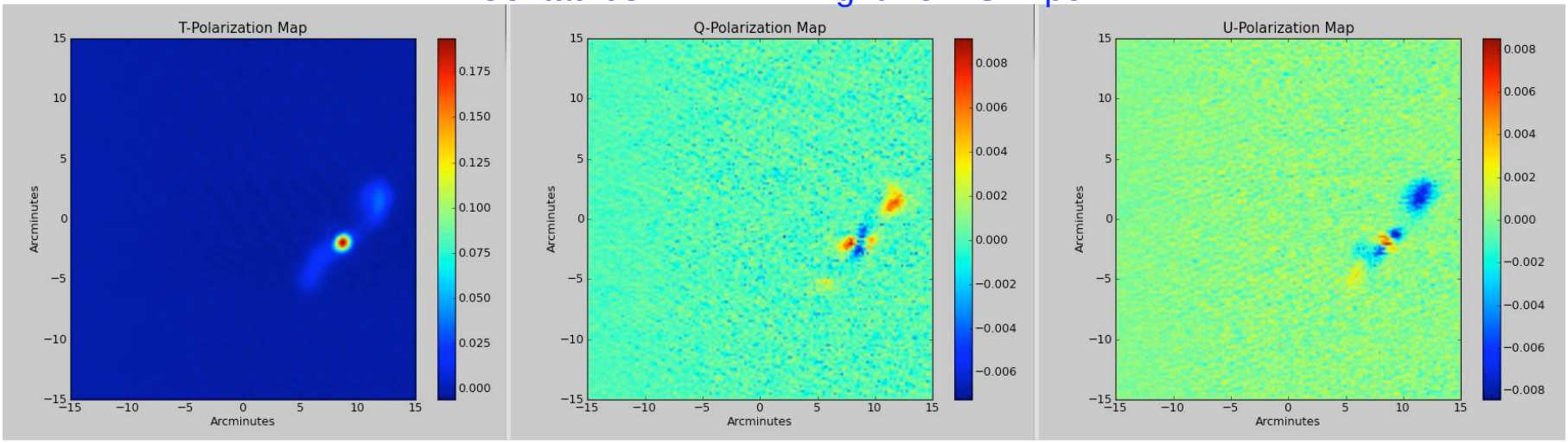

192_168_2_135_bolo_m1_c09_I
280000
270000
260000
250000
39000
40000
41000
42000
43000
44000
INDEX

First light traces from ANL detectors



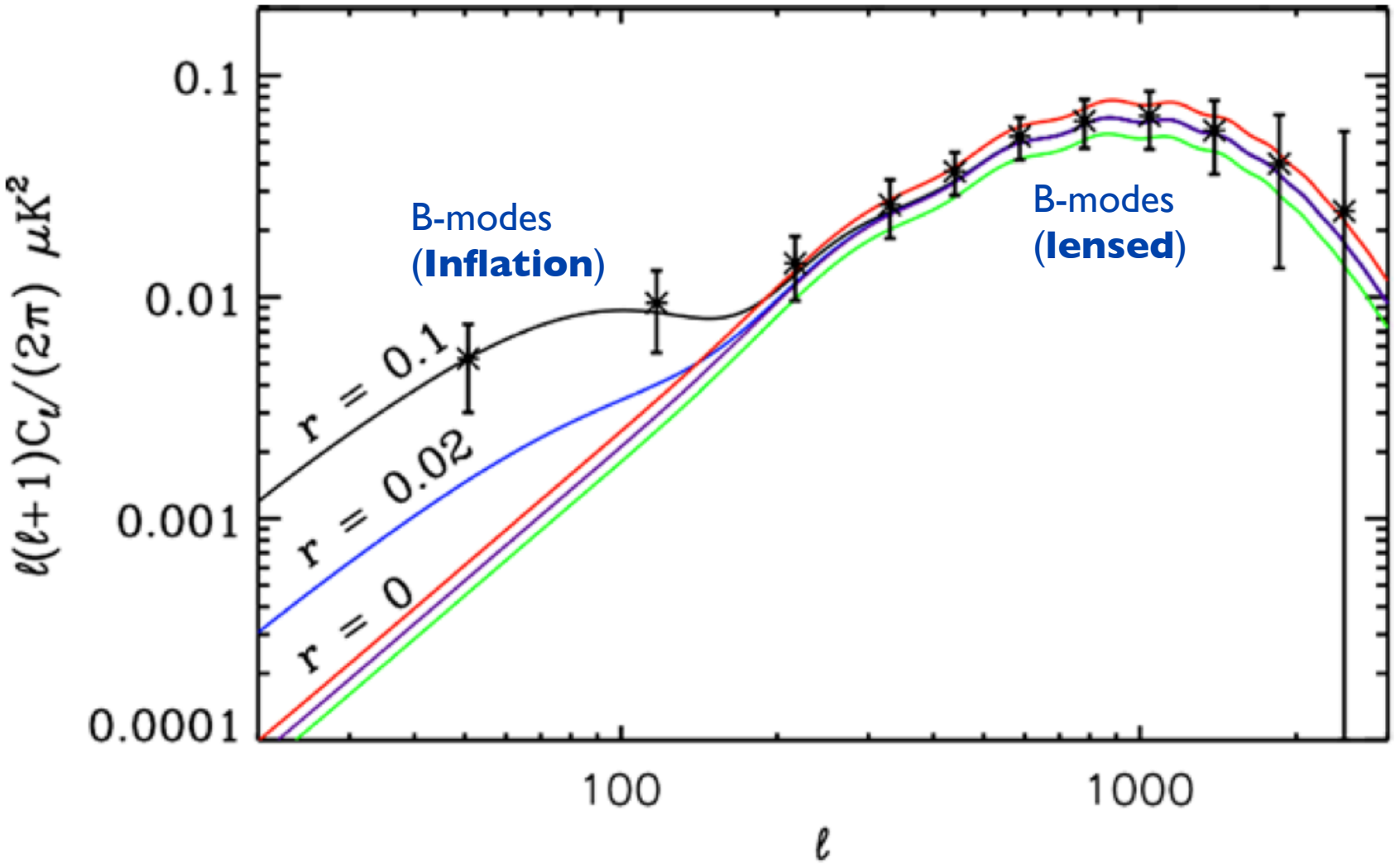
Delivered on time- Significant Milestone!

Centaurus A in 2 mm light from SPTpol



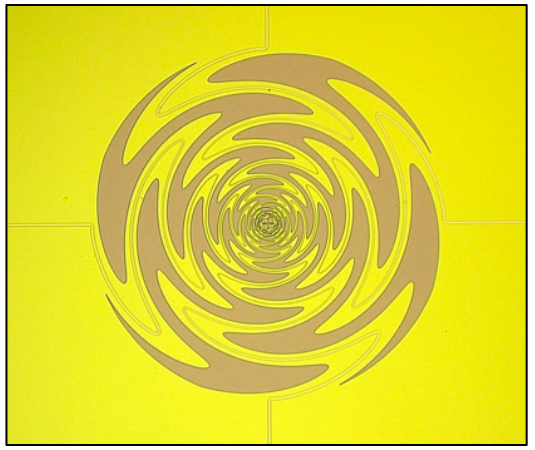
Short term goals

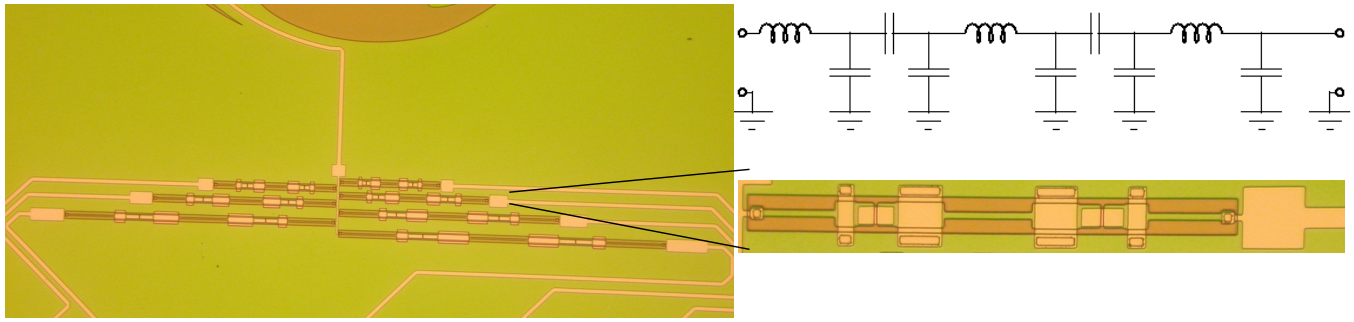
Projected 3 year SPTpol B-mode Spectrum



Long term ambitions

- Expect to be sensitivity limited
  - frontier driven by even more detectors!
  - switch detector architecture for array fabrication and mounting
  - utilize channelized superconducting microstrip to increase detector optical bandwidth (more photons per pixel)
  - expand SPT throughput (more photons), ~2500 pixels
  - R&D effort aimed at delivering new focal plane w/ 10,000-20,000 detectors in 2014





Berkeley University of California

Leverage Unique Resources & Expertise

Demonstrated track record

- Successful delivery of SPTpol focal plane
- Healthy working relationships between ANL and SPT

Broader scientific connections

- Synergy with local cosmology efforts at FNAL and KICP
- Overlap w/ DES

MSD & CNM Expertise

- Unique microfabrication & materials experience
- Dedicated deposition system
- Access to CNM
- Detectors work!

Scientific Opportunity

- Unique exploration of new Inflation parameter space (GUT scale physics)
- Synergy with DE science
- Complementary studies of the neutrino sector